

XIX. *Observations on the Honey Bee, in Continuation of the Prize Essay of the Entomological Society for the Year 1852.* By J. G. DESBOROUGH, Esq.

[Read 2nd April, 1855.]

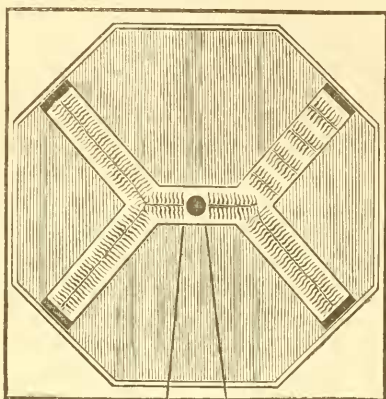
ON the 16th July, 1852, the observatory hive was stocked with a cast from a hive which had swarmed on the 4th of July. The object in stocking it with a cast in lieu of a swarm was simply that the space within the hive was thought to be too confined to admit a swarm. It had been stocked three times previously by an Apiarian friend in a situation where I had the opportunity of inspecting it daily, once with a swarm and twice with a cast; on the first occasion the bees deserted the hive entirely on the day after being hived; on the second, though the stock flourished during the summer, and the labours of the bees were constantly under inspection, the approach of winter was fatal; and on the third occasion, in the month of January, the hive was removed into my bed room, but too late to save the lives of the bees—damp and disease had taken too deep a root, and the stock died; there was plenty of food, and starvation was evidently not the cause of death. This happened in January, 1852.

My attention was then specially directed to the possibility of keeping a stock alive during the winter, so as to be able to watch the proceedings of the queen during the entire year; and notwithstanding the discouraging results of the previous attempts I resolved to establish the hive in a room in my own house, and, on the approach of winter, to watch attentively the necessities of the stock, and be guided by circumstances.

The hive was accordingly set up on the 16th July; on the 21st the queen was depositing eggs; at 10 P. M., on the 29th, a considerable quantity of the brood was sealed over; on the 5th August I counted 4,090 cells containing brood; on the 10th, young bees coming forth; on the 19th, second course of brood sealed over. Thus, during little more than a month, the queen had laid more than 8,000 eggs; the hive had been about three-fourths filled with comb, and a considerable quantity of pollen and honey had been gathered and stored. The laying of eggs was discontinued by the end of August, and the bees seemed to be

gradually sinking into a state of repose. I now digress to describe the hive.

The ground plan of the observatory hive is here represented.



It will be seen to consist of an outer case, the sides whereof are all moveable. The shaded parts are stuffed with blankets to preserve the natural heat of the bees; the white space is the part occupied by the bees, and the black dot in the centre is a hollow pivot on which the whole hive turns, and up which the bees enter the hive: the hive stands on a square board, with a long passage therein, communicating with the pivot, and joining a hole in the sill of the window at which the hive stands. The darker marks in the plan are grooves in the wooden top and bottom of the hive, in which plates of glass run, forming the sides of the hive; the ends of the hive, shown by thick black marks, are of wood, and form the support of the top of the hive, taking the weight off the glass sides; they are dovetailed loosely both top and bottom, and secured by a screw; the hive turns freely on its pivot, so that each division can be brought directly opposite the eye of the Apiarian, and this turning of the hive does not in any way interfere with the entry or exit of the bees. Guide combs were placed in the hive, so as to induce the bees to build the combs straight; in three divisions they did so, but in the fourth division the comb was not securely fastened, and on its breaking down the bees built combs across, in the direction shown by the above plan. I might probably have remedied this, and have induced the bees to build the comb parallel to the glass, but my idea was, that these combs would form a warmer and more natural situation for the bees to winter in than the other divisions, where each side of

the comb was bounded by glass, whilst here the bees might lie between two combs. I therefore did not disturb them in their work, but let it proceed; much to my astonishment, however, the bees have invariably deserted this division of the hive on the approach of winter.

To resume—during the months of September and October the bees seemed much to diminish in numbers; but this apparent loss was more seeming than real, owing to the bees clustering more closely together; still the number was gradually diminishing, but no dead bees were to be found *in* the hive.

The month of November altered the aspect of the stock; the bees were evidently sinking into a state of torpidity, and those on the outside of the cluster began to fall to the bottom of the hive. Possibly if the bees had been lying *between two combs* they would not have fallen; they could not hold on the glass, and when they lost their hold of the comb and fell to the bottom, the coldness of the air chilled them, so that they could not again crawl up the comb. During this period the space of about an inch and a half round the queen was always kept at a warmth perceptible to the hand through the glass; when, however, a day of sunshine came, most of the bees at the bottom of the hive revived, and thus the danger of a dwindling exhaustion of numbers to death seemed to be averted. During the last week of November, however, it became quite apparent that some artificial means must be resorted to for the purpose of preventing the bees lapsing into this torpid state. Under ordinary circumstances this state of torpidity might be safety; but with so much glass in the hive, which must be warmed, as well as the atmosphere of the hive, on the return of the spring it was quite clear that the stock would be absolutely starved to death long before the sun could exercise any influence sufficient to resuscitate the stock.

This state of the hive caused me great anxiety, and after much consideration I determined to try the effect of the administration of food* in small quantities. I therefore each evening gave them a small portion of food for the purpose of rousing the bees into activity; not for the want of food was it supplied, but simply to prevent the bees from sinking into a state of torpidity. Immediately after the food was supplied the heat of the hive was always increased from the commotion it caused, and the few bees which from day to day fell to the bottom of the hive, in a great measure revived from this increased heat: thus far my experiment succeeded. This system was continued during all the months of

* Honey slightly diluted with water, adding a little salt.

December, January and February, and the bees even stored the honey given to them, and sealed it over, thus showing that food was not wanted so much by them: nor indeed was that my object in supplying the food; it was merely to keep up the excitement. The room in which the bees were kept was carefully regulated as to the heat, the thermometer never being suffered to fall below 46° in the day and 40° in the night. Whenever the sun shone the hive was placed on its stand at the window and access to the outer air allowed, but at other times the hive was removed into the centre of the room; and it is really astonishing to observe the effect a few hours of even winter sunshine has upon such a hive; if the hive got really warmed by the sun the bees revived in a most extraordinary manner, much more so than from any feeding or heat derived from a fire.

I may here remark, that a limit must be had to the degree of heat at which the hive must be kept in the winter, and that too great a heat is as dangerous as too severe a cold. One night in January, having made up a good fire in the room previously to going to bed (the night threatening to be very severe), and removed the bees into the room, a sudden change took place, and the thermometer in the room stood at 65° . The hum of the bees awaked me, and the remarkable noise made by them at once evinced distress; upon opening the hive the bees were in a state of great excitement, and the temperature in the hive was 82° . I therefore set the bees on their stand, and gave them access to the air, when they gradually quieted down; the weather had suddenly changed, and it would seem that the bees were even sensible of the change, and the irritation caused by their being shut up had roused their energy and created the mischief.

These proceedings bring me to the month of March. The number of bees was now considerably reduced; I had constantly removed the dead bees, and at this time the space occupied by the bees on two sides of the comb, in one division only of the hive, was a circle of about six inches in diameter in the day, and reduced to about four inches and a half at night; the number was certainly under 1000, and I was much afraid the gradual deaths would reduce that number too low to rally. The month of February had been very frosty, and much snow fell; on the 23rd of February I had seen a grub brought out of a hive in a neighbour's garden, but I could see no signs of breeding in my observatory; still the few bees looked healthy, and the queen seemed to become more active, and I fancied increased in size; and on the 1st of March the bees began to keep very close upon

a small portion of the comb, and reposed in the cells (which hitherto they had not done). I suspected eggs were laid in these cells, but I could not see them on account of the bees being in the cells, and I did not dare to disturb them, so as to make them come out of the cells, fearing the consequence of too great irritation; and I therefore waited patiently till the 3rd of March, when I saw the queen depositing eggs, and the cells where the bees had clustered all contained brood; on the 5th the cells of brood were partly sealed over, and the space occupied by the bees was being gradually enlarged. On the 14th of March the space occupied by brood on one side of the comb measured 4×3 inches, and on the other side 5×3 inches; the number of brood, therefore, being 729. This quantity of brood had not increased since the 8th, and they were all hatched off prior to the queen again commencing laying, which she did early in April, as I detected her depositing eggs on the 4th, and on the 7th brood was again being sealed over; on the 21st of April the same space was again occupied by brood as on the 14th of March, and the breeding was now continued without interruption during the summer.

The progress of the hive may be traced by the Table, showing the quantity of brood each time of measuring, at intervals of twenty-one days; a few stray extracts from my Note Book during the summer may, however, be interesting.

“ 1853.

- March 6th. First day pollen collected, and bad weather till the 10th.
- May 6th. Brood increasing rapidly, though weather cold.
- 18th. Observed *one* drone grub sealed over amongst the workers, the cell being lengthened.
- 31st. The drone grub observed on the 18th appeared to be breaking the cover of the cell at 4 P.M.; at 10 P.M. the drone's head was uncovered, and the cell broken away to the surface of the worker comb, but it appeared dead; got him out of the cell, but he had been killed.
- June 9th. Drone cells commenced.
- 28th. Drone eggs observed.
- July 2nd. Store of honey rapidly decreasing, and the cells occupied with brood. Weather the last ten days very wet, stormy and bad.
- 15th. Drone grubs destroyed in the cells, and those sealed over torn out.
- September. Breeding ceased.”

The proceedings of the hive from this time to the 1st of November were a mere repetition of the preceding year, but the bees appeared more numerous. On the 1st of November, I began to supply small portions of food, but by the middle of the month the interior of the hive appeared excessively damp—the condensed vapour in the shape of water ran down the glass, and collected at the bottom of the hive, drowning or starving every bee happening to fall down, and the comb appearing literally soddened with wet. I bored holes in the bottom of the hive to drain off the moisture, and took every precaution I could, but still I lost a great number of bees.

On the 1st of December I discontinued the feeding, and kept the room warmer without giving access to the outer air, which had been extremely heavy and moist during the preceding month, and an improvement in the state of the hive was soon evident. The month continued very cold, and on the 26th the bees emigrated from one division of the hive to another, having consumed all the store of honey in the first division before departing. I cut out all the comb from this division, and it could only be compared to wet brown paper—still it was not mouldy.

1854. The first week of January, 1854, was excessively cold, with much snow, a thaw commencing on the 8th. I occasionally administered food during this month, but the mortality amongst the bees was very great; the interior of the hive began to be very dirty, and the bees voided their excrement on the glass, nor could I devise any means to clean it. I however cut strips of paper and laid them each day on the bottom of the hive, and thereby removing every morning the dead bees and the dirt; the paper likewise absorbed the moisture and in some measure dried the interior of the hive by that means; still the best remedy of all was the return of sunshine. On the 20th February I saw pollen collected, and on the 3rd of March I detected brood.

The bees at this period were reduced to a much smaller number than in the preceding year; and any one, however well acquainted with the habits of bees, would hardly have believed that the small number then existing would be able to rear sufficient brood to recruit the strength of the hive. The diameter of the circle occupied by the bees at this time did not exceed four inches and a half in the day, and three inches at night. It is true I took especial care that they should not want for food, and the quantity consumed was great, considering the number; no doubt the heat kept up for hatching the brood required a larger consumption of food than the mere sustenance of the life of the bee would have done. I again

refer to the Table to show the progress during the year, and add a few more extracts :—

- “1854. May 14. Honey sealed over.
 „ 24. A few drones sealed over.
 June 8. First drone seen.
 „ 18. Numbers increased so much as to require extra space, and therefore put on glasses.
 „ 25. Working in 5 glasses, and the honey deposited in the glasses in the day nearly all carried down to brood in the night.
 July 9. Observed a queen's cell, which I destroyed to prevent swarming if possible.
 „ 27. Drones killed.
 Nov. 13. Began feeding.
 „ 25. Hard frost with much sun—got out 205 dead bees.
 Dec. 3. Removed 129 dead.
 „ 10. Removed 74 apparently dead, but only 38 really so, the remainder reviving on being warmed before a fire.
 „ 31. To this time no dead removed, probably about a score lying at the bottom, but I would not disturb the hive by removing them.”

The proceedings of the hive during the summer of 1854 do not call for any especial remark, except that the drones were this year allowed by the workers to come to perfection, whilst during the preceding year (1853) they had all been killed, either in the grub or pupæ state; also that one queen's cell was begun, which was likewise not the case the former year: this cell was destroyed by me as soon as observed, my object being to keep the *same queen* under observation as long as possible. The situation of the hive in the centre of a town rendering the chance of taking a swarm from the hive extremely doubtful, my only hope of keeping the original queen under observation is to prevent swarming—hitherto I have succeeded.

Thus closes the third season of the observatory hive, embracing a period of two years and a half, during which all the labours of the bee have been incessantly watched; and although the trouble and anxiety have been great, still my efforts have been amply rewarded by the positive manner in which I can speak as to certain facts, either previously unknown to Apirians, or respecting which considerable doubt existed.

When I sent in the Essay to the Entomological Society for competition, in December, 1852, the observatory hive had only been stocked five months, and the observations upon it had only been registered for that period and had never been continued through a winter: the advertisement for such Essay was only brought under my notice in June, 1852, too late to institute any experiment on the particular subject of the Essay, and it was therefore prepared from materials certainly not collected with any—even the most remote—view to such a purpose; but it is highly gratifying to see how nearly the actual admeasurement of the numbers produced in a hive during the season corresponds proportionately with the table contained in the Essay (which, of course, was but an approximation of the *actual* number of bees bred in a hive). The total numbers are much smaller in the observatory hive than in the table of the Essay, but it must be borne in mind that the cubical contents of the observatory is much smaller than an ordinary hive.

It will be seen by the detailed proceedings of this stock of bees, that from July, 1852, to June, 1854, *no drones were existing in the hive*; consequently no second impregnation of the queen could take place during that period, and therefore that all the eggs produced were the result of *one* impregnation; thus proving at least that *the impregnation of the queen lasts for more than one season*.

On reference to the notes of the year 1853, it will be seen that the 6th of March was the first day of pollen being collected—now on that day, 729 bees had been reared and sealed over without a particle of pollen or bee bread being present in the hive; all had been consumed previously; this I can speak to positively, because by removing the covers from opposite sides of any division of the hive, I was enabled to look through the comb, and on doing this no bee bread could be seen, the cells were all clearly to be seen through. I am now speaking of the month of February. I had fully expected to see brood before that time; and finding no bee bread, and the season being so backward that none could be collected, I naturally attributed the want of brood to the absence of pollen. I therefore cut up the comb from a dead hive and supplied pieces containing pollen, but the bees in the observatory would not touch it, and when I saw brood and that the bees refused to eat the pollen, I removed the comb altogether; and I can positively aver, that these 729 bees were reared with no other food than honey—honey and honey alone is the food of the grub of the bee. Since that time I have anxiously watched the parts of the hive where bee bread has been deposited, and the matured bees *during the*

night may be observed feeding on the bee bread; indeed almost every cell containing pollen will have a bee half in the cell eating the pollen--the pollen is mixed with honey, and this is likewise done in the night, as the cells containing bee bread fresh brought into the hive may be seen in an afternoon dry and the pellets may be distinguished, but the next morning all traces of such pellets will be gone, and the surface of the pollen in every cell will be smooth and evidently mixed with honey.

The result then of the observations made during the period of two years and a half is the proof of these two facts in bee economy, viz., that the impregnation of the queen extends over more than one season, and that the food of the bee in the grub state is honey, and not farina or pollen. Though these may not be considered very important, yet when they can be asserted not merely as speculative theories, but as clearly demonstrated facts, it must be a further step to the more perfect knowledge of the habits of the insect.

Since the preparation of the Essay, in December, 1852, I have certainly continued the observations with a view to prove the conclusions drawn by me as to the duration of life in the bee. As to the queen, the time of direct observation has not yet been extended sufficiently to add to anything said in the Essay as to her life: as to the drone, in the year 1853 none were brought to perfection, and in 1854 they were killed at the ordinary time as in a common hive; and as to the worker the calculation of the numbers produced, and the state of the hive in the spring, especially at the period when the longest lived bees die off, are so confirmatory of my views as to their duration of life, that I have no hesitation in reiterating, that the maximum period of the life of the worker bee is eight months.

In the winter of 1853-4, I omitted to note the number of dead bees from time to time removed by me--during this present winter I have done so, and I am much inclined to think that great assistance will be obtained thereby in determining positively the duration of their life; but as I have only brought this paper down to the end of the year 1854, I hope on a future occasion to have the pleasure of continuing my history of the observatory hive, and stating at length the result of future observations.

One of the conditions under which the Prize Essay was sent to the Entomological Society being that it *must present the result of original experiments*, it was of course prepared to meet that view: and in continuing the present paper the same course has been followed, and any reference to published works on the subject

carefully avoided: the history of the experiment has been invariably given before any conclusion is drawn from it, thus accounting for the somewhat egotistical style in which both papers might otherwise appear; still the original Essay and this present paper are in the end, using the words of an eminent member of the Entomological Society, only what they profess to be—"direct observations of fact rather than speculative theories of which there have been too many among Apirians."

TABLE SHOWING THE ACTUAL NUMBER OF BEES PRODUCED IN THE OBSERVATORY HIVE DURING THE YEARS 1852, 1853 AND 1854.

1852.		1853.		1854.	
Time of measuring Brood.	Number.	Time of measuring Brood.	Number.	Time of measuring Brood.	Number.
August 5	4090	March 14	729	March 17	283
" 26	2970	April 21	729	April 9	1215
		May 16	1296	" 30	1215
		June 5	3280	May 21	2430
		" 26	6912	June 11	4279
		July 16	8316	July 2	10,435
		August 7	2439	" 23	9099
				August 13	1404
				September 3	972
	<u>7060</u>		<u>23,701</u>		<u>31,332</u>
		1852.....	7060		
		1853.....	23,701		
		1854.....	31,332		
		Total of three Seasons.....	62,093		